impurities in amounts of the order of tens of weight ppm. Accordingly, claims 5, 7-12, 14, 15, 17-19, 21, and 22 are pending and at issue.

Claims 5-8 and 15-22 have been rejected under 35 U.S.C. §103(a) as obvious over Japanese Patent Publication Nos. 62047443 (JP '443) and 61133351 (JP '351). Claims 5-22 have been rejected under 35 U.S.C. §103(a) as obvious over Japanese Patent Publication Nos. 10195562 (JP '562) or 09078162 (JP' 162).

The Examiner asserts that the impurities in the copper alloys recited in JP '443, JP '351, JP '562, and JP '162 would inherently possess the impurities recited in pending claims.

Each of the cited prior art references describe *refined* copper microalloys. Refining processes typically remove impurities. Therefore, unless indicated otherwise, the copper microalloys described in JP '443, JP '351, JP '562, and JP '162 do not necessarily contain impurities other than those recited. For example, the refined copper microalloys disclosed in two references attached as Exhibits A and B do not contain zinc (Zn) or tin (Sn).

None of these references disclose or suggest a copper microalloy having all of the impurities in the amounts recited in the pending claims.

For the foregoing reasons, the cited prior art fails to render obvious the claimed invention. Accordingly, applicants respectfully request withdrawal of this rejection.

In view of the above amendments and remarks, it is respectfully requested that the application be reconsidered and that all pending claims be allowed and the case passed to issue.

If there are any other issues remaining which the Examiner believes could be resolved through either a Supplemental Response or an Examiner's Amendment, the Examiner is respectfully requested to contact the undersigned at the telephone number indicated below.

Respectfully submitted

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Marked-Up Claims
Accompanying September 23, 2002 Amendment
For U.S. Serial No. 09/499,207
(Docket No. 2136/0G684)

5. (Twice Amended) A method for the manufacture of a copper microalloy comprising:

(a) mixing a copper alloy containing S, Se, As, Sb, Bi, Sn, Zn, Ni, Fe, Ag or Te impurities in amounts of the order of tens of weight ppm, with lead to yield a microalloy having a final concentration of at least 200 weight ppm of lead, wherein the copper alloy contains Zn, Fe, Ni, Sn, and Ag impurities in amounts of the order of tens of weight ppm; and

(b) continuous casting the microalloy.

9. (Twice Amended) A method for the manufacture of a copper microalloy containing lead, comprising:

(a) mixing a copper alloy containing (1) S, Se, As, Sb, Bi, Sn, Zn, Ni, Fe, Ag, or Te impurities in amounts of the order of tens of weight ppm and (2) less than 80 weight ppm of the impurities Zn, Ag, Cd, Sb, Ni, Fe, Bi, Sn and S with lead to yield a microalloy having at least 200 weight ppm of lead, wherein the copper alloy contains Zn, Fe, Ni, Sn, and Ag impurities in amounts of the order of tens of weight ppm;

(b) continuous casting the microalloy from step (a); and

(c) heating the miroalloy from step (b) at 550-650° C for 5-600 seconds to decrease its half-softening temperature, annealing temperature, and recrystallization temperature to below 200° C.

15. (Amended) A method for the manufacture of a copper microalloy comprising:

(a) mixing a copper alloy consisting essentially of copper and one or more of S, Se, As, Sb, Bi, Sn, Zn, Ni, Fe, Ag and Te impurities in amounts of the order of tens of weight ppm, with lead to yield a microalloy having a final concentration of at least 200 weight ppm of lead, wherein the copper alloy contains Zn, Fe, Ni, Sn, and Ag impurities <u>in amounts of the order of tens of weight ppm</u>; and

(b) <u>continuous</u> casting the microalloy.

19. (Amended) A method for the manufacture of a copper microalloy comprising:

(a) mixing a copper alloy consisting of copper and one or more of S, Se, As, Sb, Bi, Sn, Zn, Ni, Fe, Ag and Te impurities in amounts of the order of tens of weight ppm, with lead to yield a microalloy having a final concentration of at least 200 weight ppm of lead, wherein the copper alloy contains Zn, Fe, Ni, Sn, and Ag impurities <u>in amounts of the order of tens of weight ppm</u>; and

(b) <u>continuous</u> casting the microalloy.

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Pending Claims
(After September 23, 2002 Amendment)
For U.S. Serial No. 09/499,207
(Docket No. 2136/0G684)

5. (Twice Amended) A method for the manufacture of a copper microalloy comprising:

(a) mixing a copper alloy containing S, Se, As, Sb, Bi, Sn, Zn, Ni, Fe, Ag or Te impurities in amounts of the order of tens of weight ppm, with lead to yield a microalloy having a final concentration of at least 200 weight ppm of lead, wherein the copper alloy contains Zn, Fe, Ni, Sn, and Ag impurities in amounts of the order of tens of weight ppm; and

(b) continuous casting the microalloy.

7. The method of claim 5, wherein the microalloy has a lead content of more than 300 weight ppm.

8. The method of claim 5, wherein the microalloy has a lead content of more than 350 weight ppm.

9. (Twice Amended) A method for the manufacture of a copper microalloy containing lead, comprising:

(a) mixing a copper alloy containing (1) S, Se, As, Sb, Bi, Sn, Zn, Ni, Fe, Ag, or Te impurities in amounts of the order of tens of weight ppm and (2) less than

80 weight ppm of the impurities Zn, Ag, Cd, Sb, Ni, Fe, Bi, Sn and S with lead to yield a microalloy having at least 200 weight ppm of lead, wherein the copper alloy contains Zn, Fe, Ni, Sn, and Ag impurities in amounts of the order of tens of weight ppm;

(b) continuous casting the microalloy from step (a); and

(c) heating the miroalloy from step (b) at 550-650° C for 5-600 seconds to decrease its half-softening temperature, annealing temperature, and recrystallization temperature to below 200° C.

10. The method of claim 9, wherein the microalloy has a lead content of more than 300 weight ppm.

11. The method of claim 9, wherein the microalloy has a lead content of more than 350 weight ppm.

12. The method of claim 9, wherein the hydrogen content of the microalloy is 0.5-0.7 weight ppm after casting.

14. The method of claim 9, whereby the electrical conductivity of the microalloy is increased to values greater than 101% IACS.

15. (Amended) A method for the manufacture of a copper microalloy comprising:

(a) mixing a copper alloy consisting essentially of copper and one or

more of S, Se, As, Sb, Bi, Sn, Zn, Ni, Fe, Ag and Te impurities in amounts of the order of tens of weight ppm, with lead to yield a microalloy having a final concentration of at least 200 weight ppm of lead, wherein the copper alloy contains Zn, Fe, Ni, Sn, and Ag impurities in amounts of the order of tens of weight ppm; and

(b) continuous casting the microalloy.

17. The method of claim 15, wherein the microalloy has a lead content of more than 300 weight ppm.

18. The method of claim 15, wherein the microalloy has a lead content of more than 350 weight ppm.

19. (Amended) A method for the manufacture of a copper microalloy comprising:

(a) mixing a copper alloy consisting of copper and one or more of S, Se, As, Sb, Bi, Sn, Zn, Ni, Fe, Ag and Te impurities in amounts of the order of tens of weight ppm, with lead to yield a microalloy having a final concentration of at least 200 weight ppm of lead, wherein the copper alloy contains Zn, Fe, Ni, Sn, and Ag impurities in amounts of the order of tens of weight ppm; and

(b) continuous casting the microalloy.

21. The method of claim 19, wherein the microalloy has a lead content of more than 300 weight ppm.

22. The method of claim 19, wherein the microalloy has a lead content of more than 350 weight ppm.

Extractive Metallurgy of Copper

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TABLE 15.1. INDUSTRIAL RANGE OF ANODE AND CATHODE COMPOSITIONS IN MODERN REFINERIES[a]

Element	Anodes (range of %)	Cathodes (range of %)
Cu	99.4–99.8	99.99+
O	0.1–0.3	(not included in analysis)
Ni	0–0.5	trace–0.0010
Pb	0–0.1	trace–0.0005
As	0–0.3[a]	trace–0.0002
Sb	0–0.3[a]	trace–0.0002
Se	0–0.02	trace–0.0002
Fe	0.002–0.03	0.0002–0.0020
Te	0–0.001	trace–0.0001
S	0.001–0.003	0.0004–0.0016
Bi	0–0.01	trace–0.0001
Ag	trace–0.1	0.0005–0.001
Au	0–0.005	0–0.00001

[a] Eichrodt and Schloen (1954).

immersed in a cell containing an acidified copper sulphate solution, causes the following reactions and processes to take place:

(a) Copper is electrochemically dissolved from the anode into the solution, i.e.

$$Cu^{\circ}_{anode} \rightarrow Cu^{2+} + 2e^{-} \qquad E^{\circ} = +0.34\ V \qquad (15.1)$$

producing copper cations plus electrons.

(b) The electrons produced by reaction (15.1) are conducted towards the cathode through the external circuit and power supply.

(c) The Cu^{2+} cations in the solution migrate by diffusion and convection to the negative electrode (cathode).

(d) The electrons and the Cu^{2+} ions recombine at the cathode surface to produce copper metal which plates on the cathode, i.e.

$$Cu^{2+} + 2e^{-} \rightarrow Cu^{\circ} \qquad E^{\circ} = +0.34\ V \qquad (15.2)$$

The net effects are the electrochemical dissolution of copper from the anode, the migration of electrons and copper ions towards the cathode,

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INGENIERÍA ELECTROQUÍMICA

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a fin de obtener ánodos con proporción uniforme de plata y con una cantidad tolerable de impurezas.

Los cátodos de cobre refinado, de superficie lisa, contienen más del 99.98 % de cobre, en tanto que los cátodos de superficie rugosa sólo contienen el 99.95 %. Su ar-

TABLA 28. ANÁLISIS DE COBRE BLISTER, DE LOS ÁNODOS Y DE LOS CÁTODOS

Análisis	*Blister*	*Ánodo*	*Cátodo*
Cobre	99.0140 %	99.4220 %	99.9800 %
Oxígeno	0.6910 %	0.1540 %	
Azufre	0.0185 %	0.0026 %	
Arsénico	0.0464 %	0.0435 %	0.0010 %
Antimonio	0.0350 %	0.0317 %	0.0010 %
Plomo	0.0039 %	0.0042 %	nulo
Selenio	0.0184 %	0.0176 %	0.0003 %
Teluro	0.0122 %	0.0122 %	0.0002 %
Níquel	0.0140 %	0.0146 %	0.0016 %
Plata	1980 g/t	1950 g/t	9.4 g/t
Oro	9.25 g/t	9.25 g/t	

TABLA 29. CUADERNO DE LA MARCHA DE UN TANQUE

Peso total de los ánodos	6379.7 kg
Peso del residuo de los ánodos	761.1 kg
Peso de los ánodos	5618.7 kg
Duración total de la electrólisis	31 d 17 h 55 min
Peso del cobre depositado	5389.1 kg
Intensidad media durante el proceso	6700 A
Rendimiento de corriente	91.3 %
Barro:	
Cantidad	2636.5 kg
Barro en unidad de peso por tonelada de cobre refinado	4.18 kg
Análisis del barro:	
Cobre	18.80 %
Plata	51.008 % 515 kg/t
Oro	0.2171 % 2170 g/t
Arsénico	3.90 %
Antimonio	8.04 %
Plomo	1.06 %
Selenio	4.37 %
Teluro	2.99 %
Níquel	0.05 %

del 0.001 %, y el antimonio, de más de 0.030
sénico ha bajado del 0.040 % a menos del 0.001 %, y el antimonio, de más de 0.030 a menos de 0.001 %. El selenio y el teluro, que figuraban en el ánodo en proporción de más del 0.01 %, han disminuido hasta el punto de que el cátodo contiene menos de 0.0003 %. En el cátodo, una vez terminado, la mayor impureza la constituyen los gases absorbidos, que representan más de la mitad del 0.02 % que no es cobre.

El análisis ponderal del cobre anódico y del barro, para un tanque cualquiera,

M—— —